SEEBECK EFFECT CVD-DIAMOND/PD GAS SENSORS

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Abstract

The operation of sensors in environments characterized by high temperature, high pressure, chemical activity or nuclear radiation are increasing their relevance in several engineering applications. Thus, the development of sensors based on materials suitable for operation in harsh environment is desirable. The outstanding physical and chemical properties of Chemical Vapor Deposition diamond could then be profitably exploited in the realization of electronic devices that could work when commercial sensor fail. To this purpose, a thermochemical sensor was designed using p-type CVD-diamond films and Palladium. The sensor was tested for different temperature drops, showing values of the thermoelectric power as high as 400 ìV/°C with good stability. The catalytic properties of thin palladium films [1] allow the thermocouple to be used for gas detection. As an example the hydrogen content, within a hydrogen-nitrogen gas mixture, was measured by the changes occurred in the Seebeck output voltage, showed by the thermocouple, at constant values of the temperature drop. The sensor response was measured for hydrogen contents varying between 0.5 % and 2 %.

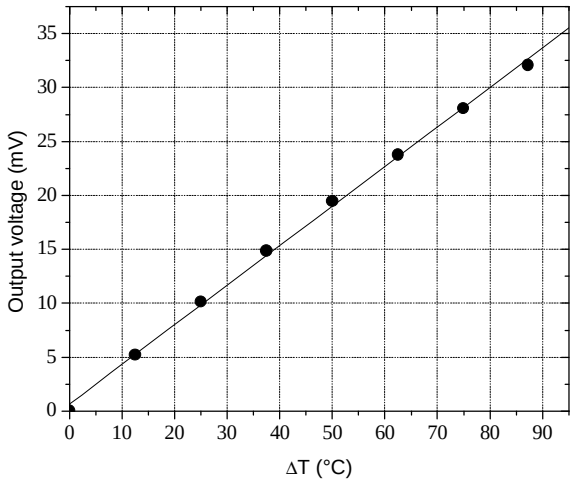
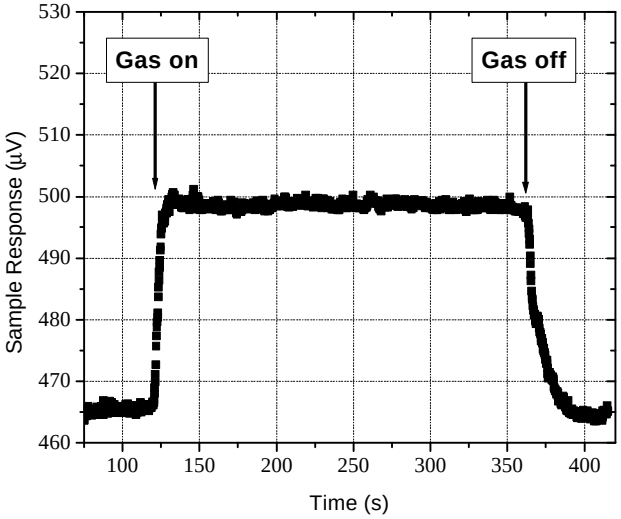


Figure 1 Thermoelectric response of the boron-doped-diamond/Pd thermocouple for a 0 °C reference temperature.



Fiure. 2 Diamond/Pd thermocouple signal when 0.5% H_2 is introduced in the test chamber.

REFERENCES

1. F.C. Thompkins, Academic Press, New York, 1978
2. Van Herwaarden, A.W., Van Duyn, D.C.; Van Oudheusden, B.W.; Sarro, P.M.. Sensors and Actuators A, 22 (1990),621-630
3. A. Bearzotti, M. Gentili, A. Lucchesini, C. Caliendo, E. Verona, A. D'Amico, Sensors and Actuators A, 21-23 (1990), 631-635.